

British Judo Association



Long Term Development

Important Note: This handout is not meant as a stand-alone document. It is a supplement to the 'Talent Identification and Talent Development' workshops/courses where the underlying concepts are fully explained and their relevance to a judo training programme is discussed.

Reasons for Long-Term Development

Talent identification and development processes need to acknowledge that early success will not automatically lead to adulthood success; as growth, maturation and development are all components that affect an athlete's potential (Malina, 2010). To allow for this 'dynamic nature of talent', selections should be also based on improvements and behaviours of the athlete within a development program (Abbott & Collins, 2002).

TI and TD based on age-group excellence regularly eliminates many late-maturing, but potentially talented athletes. Additionally, athletes that have achieved childhood success are frequently deselected once their early physical advantages are removed, often resulting in demotivation and premature withdrawal from sport (Abbott & Collins, 2002).

Physiological Considerations of the Developing Judoka

Growth, Maturation & Gender Differences

Maturation can be approximated by monitoring growth and calculating Peak Height Velocity (PHV). This can be used to individualise the athletes training programme based on their biologic age, rather than their chronological age (Lloyd & Oliver, 2012).

PHV in females occurs around 12yrs, with menarche following approximately one-year after. In males PHV occurs around 14yrs, with Peak Strength Velocity (PSV) happening around one year later (Ross & Marfell-Jones, 1991).

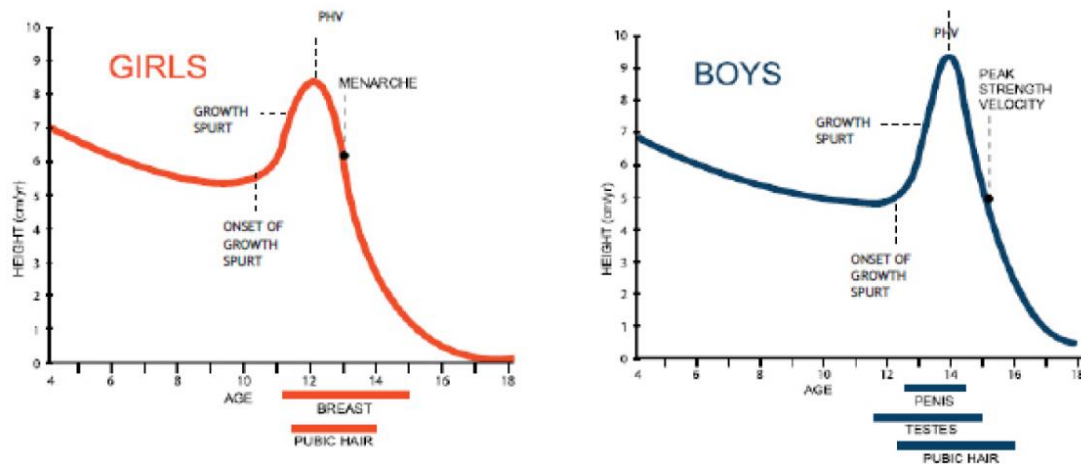


Figure 1 – Maturity Events in Girls & Boys

Maturation can occur two or more years before or after these average ages; early-maturers may have up to a four-year physiological advantage over late-maturers (Ross & Marfell-Jones, 1991).

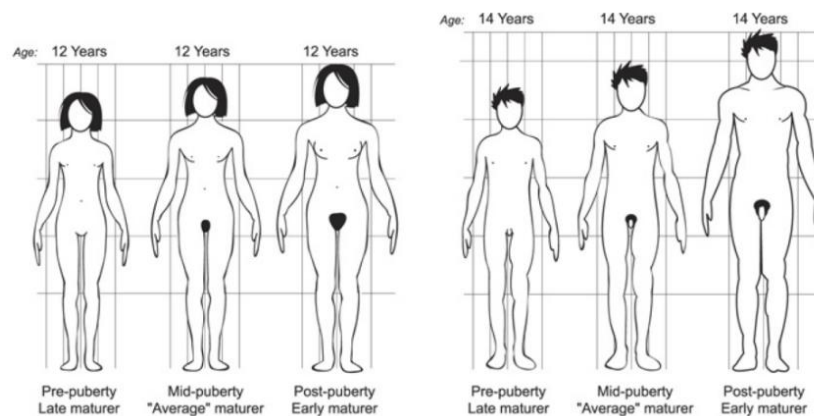


Figure 2 – Maturation in Girls and Boys

As judo is a weight-class sport judo coaches need to consider that PHV and PWV are linked; during this time the judoka should be expected to increase in weight, as rapidly as they increase in height.

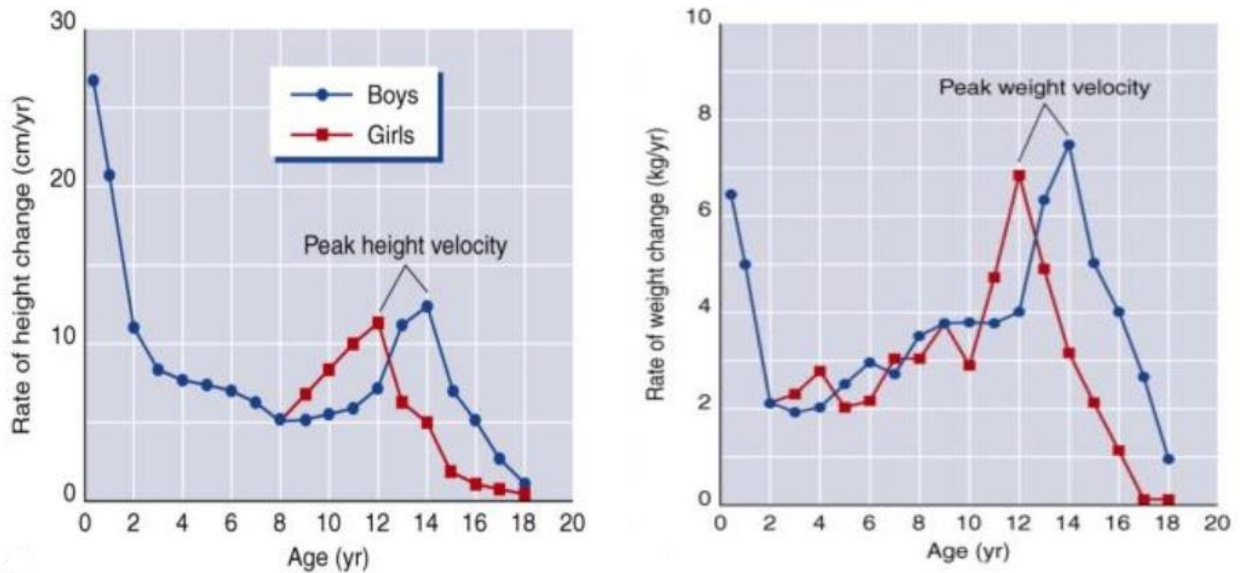


Figure 3 – Peak Height & Weight Velocity

Training Age

Training age is the number of years the athlete has participated in formalised training, it is important that coaches consider this factor. Late starters to judo should begin with FMS development and strength training, before they undertake the SSS training expected of an early starter of the same age. Conversely, early starting and early-maturing athletes could be exposed to more progressed training programmes (Lloyd & Oliver, 2012).

Models of Long-Term Development

Long-Term Athlete Development Model

The Long-Term Athlete Development Model (LTAD; Balyi & Hamilton, 2004) is based on the “10,000-hour rule” which states that it takes 10 years of deliberate practice to reach expert performance (Ericsson, Krampe, & Tesch-Römer, 1993).

The LTAD model provides a framework for the optimal development of physical skills by taking advantage of ‘windows of optimal trainability’; these windows utilise Peak Height Velocity (PHV) as a reference point to identify critical periods of growth, maturation and development.

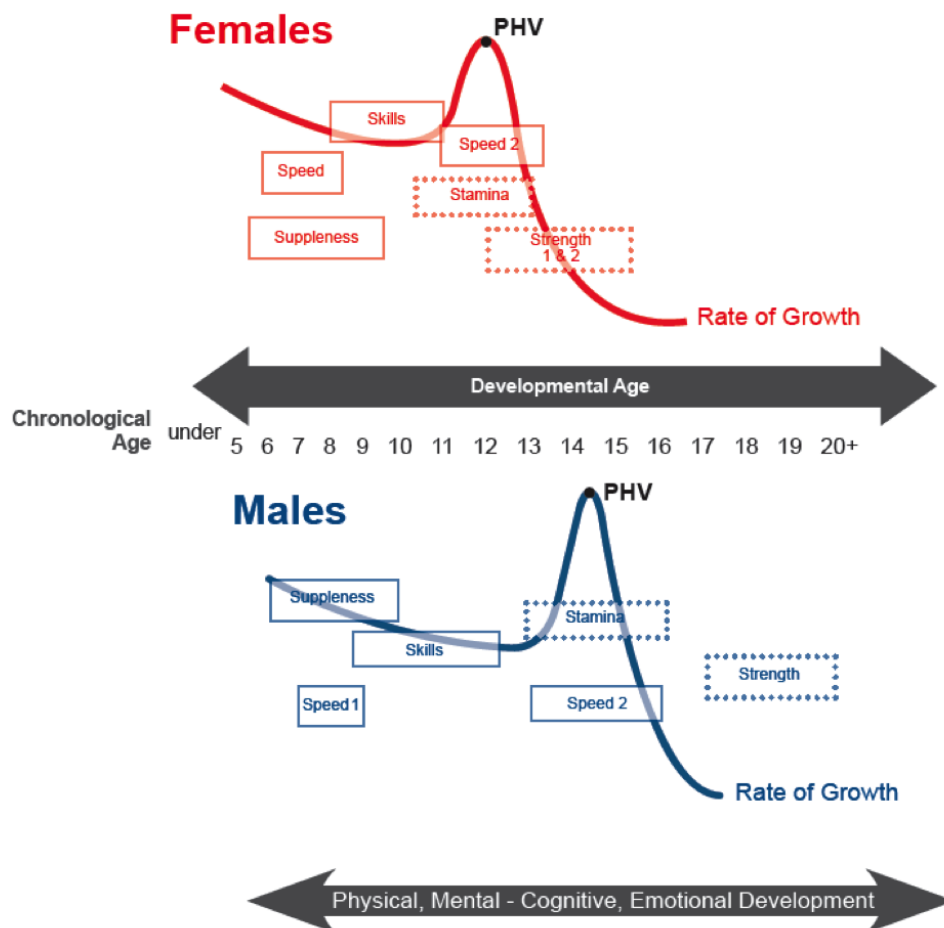


Figure 4 – Windows of Accelerated Adaption to Training

The benefits of the LTAD model are that it presents training development based on biological age, rather than chronologic and acknowledges the psychical/developmental differences between genders. The disadvantages are that's its guidance on training activities is limited, plus research has shown that it lacks evidence and validity. (Lloyd et al., 2015).

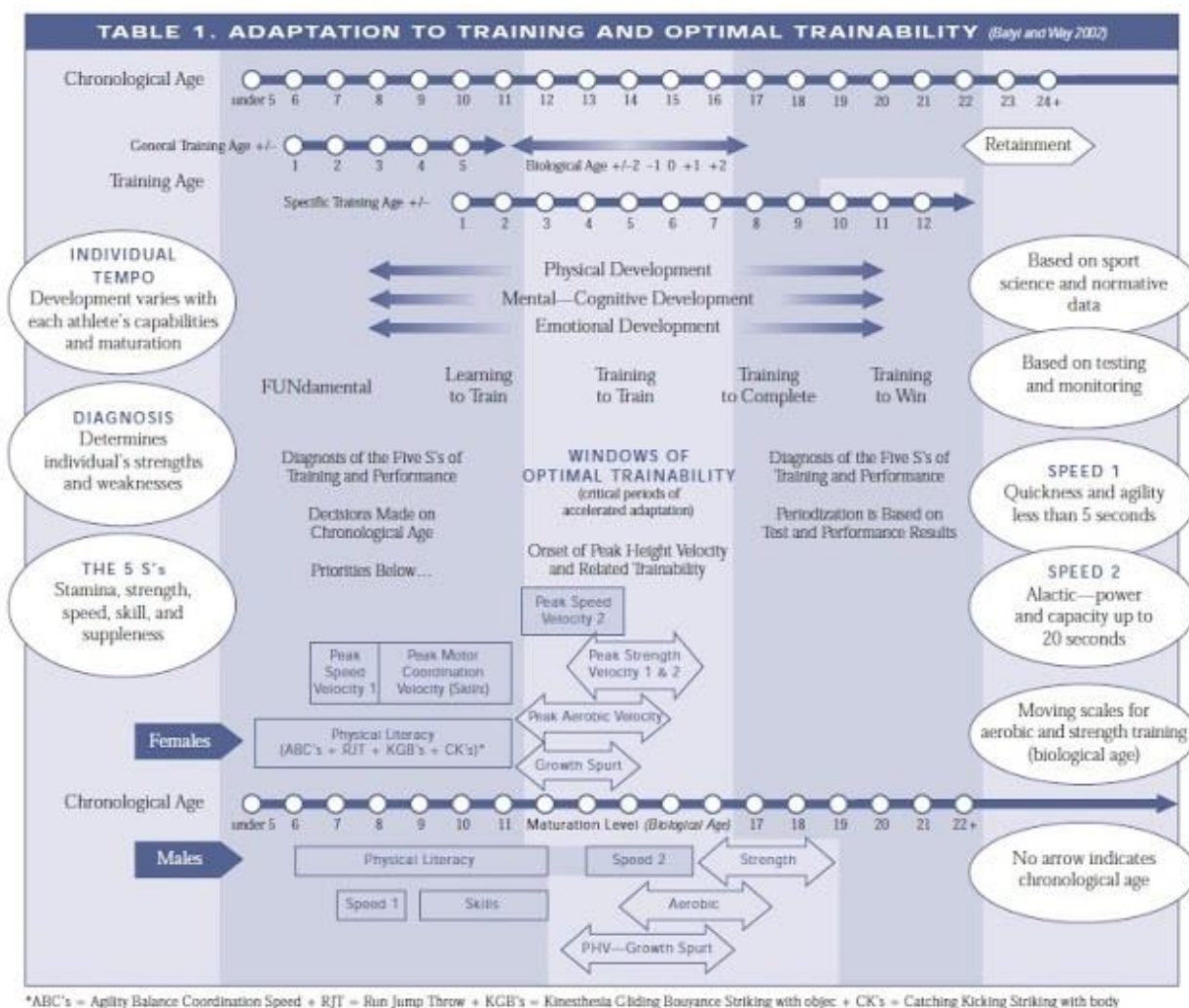


Figure 5 – Adaptation to Training and Optimal Trainability

The Developmental Model of Sport Participation

The Developmental Model of Sport Participation (DMSP; Côté, Baker & Abernethy, 2007) presents quantifiable and testable concepts for athlete development. Its stages are based on theories of both child and sport development.

The DMSP proposes various sporting outcomes (performance, participation and personal development) by concentrating on fundamental processes (deliberate play/practice and early specialisation/diversification) and the environments in which these take place (the roles of coaches, parents and peers) (Côté & Vierimaa, 2014).

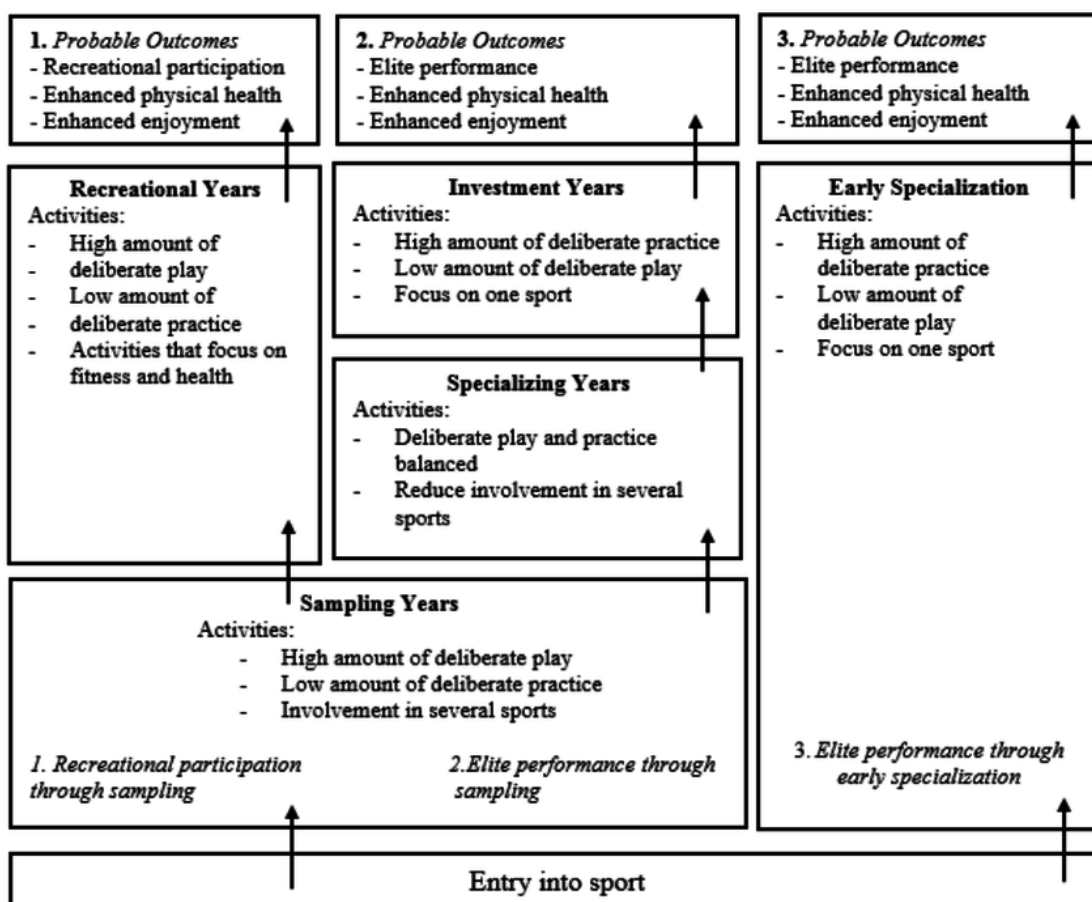


Figure 6 - Developmental Model of Sport Participation

The benefits of the DMSP are that it encourages the sampling of multiple sports during childhood and supports that elite performance can be achieved via both early and late specialisation. The disadvantages are that it provides no guidance on training activities and is based on interviews of elite athletes (Lloyd et al., 2015).

Youth Physical Development Model

The Youth Physical Development Model (YPD; Lloyd & Oliver, 2012) is an evidence-based method for the development of young athletes' physical performance.

The YPD Model provides a structure for the development of nine identified physical qualities and rationale for the emphasis of these components during different age periods; also recognising that these components are trainable during all stages of development (Lloyd & Oliver, 2012). These are summarised in section 4.4.

The benefits of the YPD model are that it provides rationale for training activities based on research; highlighting the importance of muscle-based strength and movement competency. The disadvantages are that it solely focuses on physical development, with no psycho-social parameters (Lloyd et al., 2015).

YOUTH PHYSICAL DEVELOPMENT (YPD) MODEL FOR MALES																					
CHRONOLOGICAL AGE (YEARS)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21+	
AGE PERIODS	EARLY CHILDHOOD			MIDDLE CHILDHOOD							ADOLESCENCE							ADULTHOOD			
GROWTH RATE	RAPID GROWTH ↔			STEADY GROWTH ↔							ADOLESCENT SPURT ↔				DECLINE IN GROWTH RATE						
MATURATIONAL STATUS	YEARS PRE-PHV ←										PHV		→ YEARS POST-PHV								
TRAINING ADAPTATION	PREDOMINANTLY NEURAL (AGE-RELATED) ↔										COMBINATION OF NEURAL AND HORMONAL (MATURITY-RELATED)										
PHYSICAL QUALITIES	FMS			FMS				FMS				FMS									
	SSS			SSS				SSS				SSS									
	Mobility			Mobility							Mobility										
	Agility			Agility							Agility				Agility						
	Speed			Speed							Speed				Speed						
	Power			Power							Power				Power						
	Strength			Strength							Strength				Strength						
	Hypertrophy										Hypertrophy		Hypertrophy							Hypertrophy	
	Endurance & MC			Endurance & MC							Endurance & MC				Endurance & MC						
TRAINING STRUCTURE	UNSTRUCTURED			LOW STRUCTURE							MODERATE STRUCTURE				HIGH STRUCTURE				VERY HIGH STRUCTURE		

Figure 7 – Youth Physical Development Model for Males

Font size refers to importance; light blue boxes refer to preadolescent periods of adaptation, dark blue boxes refer to adolescent periods of adaptation. FMS = fundamental movement skills; MC = metabolic conditioning; PHV = peak height velocity; SSS = sport-specific skills.

YOUTH PHYSICAL DEVELOPMENT (YPD) MODEL FOR FEMALES																								
CHRONOLOGICAL AGE (YEARS)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21+				
AGE PERIODS	EARLY CHILDHOOD			MIDDLE CHILDHOOD					ADOLESCENCE							ADULTHOOD								
GROWTH RATE	RAPID GROWTH			↔ STEADY GROWTH ↔					↔ ADOLESCENT SPURT ↔				↔ DECLINE IN GROWTH RATE											
MATURATIONAL STATUS	← YEARS PRE-PHV ←							PHV				→ YEARS POST-PHV →												
TRAINING ADAPTATION	PREDOMINANTLY NEURAL (AGE-RELATED)								↔ COMBINATION OF NEURAL AND HORMONAL (MATURITY-RELATED)															
PHYSICAL QUALITIES	FMS			FMS			FMS			FMS														
	SSS			SSS			SSS			SSS														
	Mobility			Mobility					Mobility															
	Agility			Agility					Agility				Agility											
	Speed			Speed					Speed				Speed											
	Power			Power					Power				Power											
	Strength			Strength					Strength				Strength											
	Hypertrophy								Hypertrophy				Hypertrophy							Hypertrophy				
	Endurance & MC			Endurance & MC					Endurance & MC							Endurance & MC								
TRAINING STRUCTURE	UNSTRUCTURED			LOW STRUCTURE					MODERATE STRUCTURE				HIGH STRUCTURE				VERY HIGH STRUCTURE							

Figure 8 – Youth Physical Development Model for Females

Font size refers to importance; light pink boxes refer to preadolescent periods of adaptation, dark pink boxes refer to adolescent periods of adaptation. FMS = fundamental movement skills; MC = metabolic conditioning; PHV = peak height velocity; SSS = sport-specific skills.

Composite Youth Development Model

The Composite Youth Development Model (CYD; Lloyd et al., 2015) combines the YPD model with an adapted DMSP model. Integrating talent, psycho-social and physical development across maturation stages.

Lloyd et al. (2015) adapted the DMSP to highlight that early specialisation often has the outcomes of reduced physical activity and enjoyment in adulthood, whereas later specialisation tends to have the outcomes of enhanced physical activity and enjoyment in adulthood.

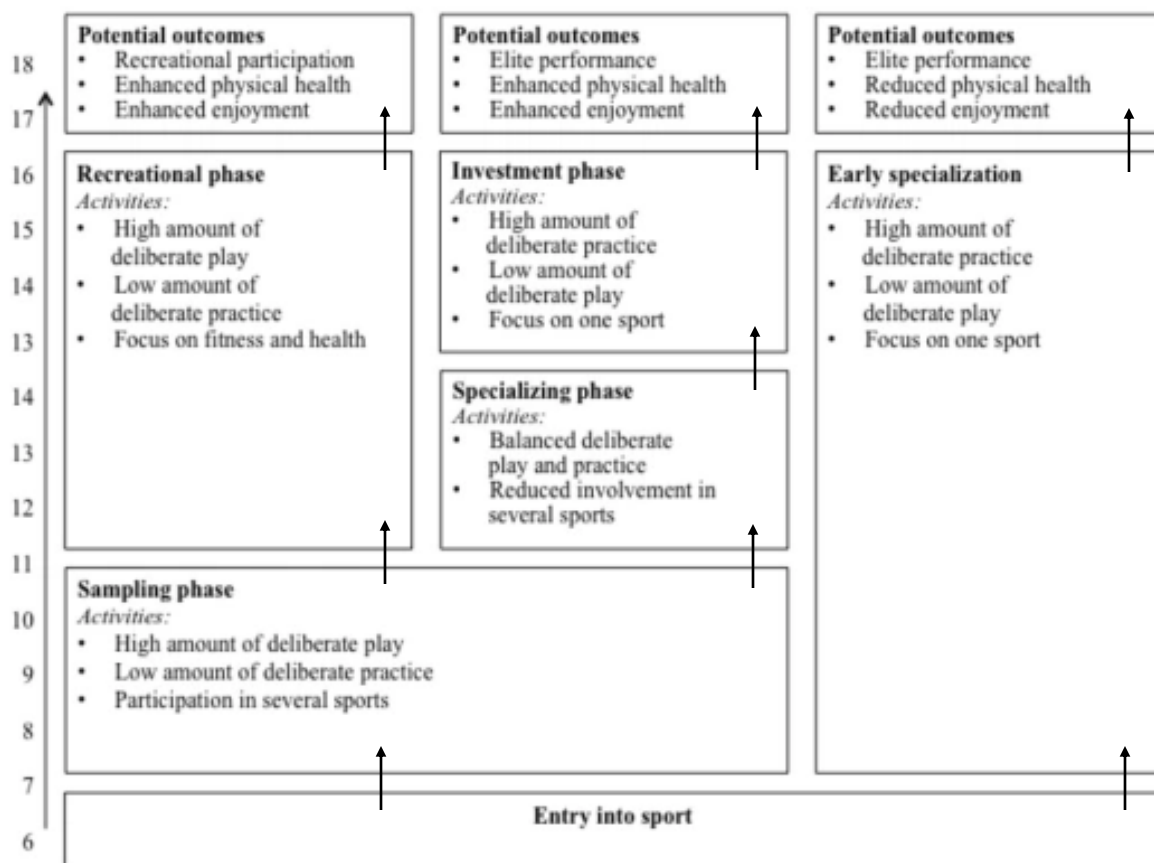


Figure 9 – Adapted Developmental Model of Sport Participation

The CYD model provides a strategic youth development plan for maximising sporting talent with the development of long-term physical fitness, health and well-being whilst increasing physical activity participation rates and reducing the possibility of sport injuries (Lloyd et al., 2015).

Composite YPD Model for Males																				
CHRONOLOGICAL AGE YEARS	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21+
AGE PERIODS	Early childhood			Middle Childhood						Adolescence						Adulthood				
MATURATIONAL STATUS	YEARS PRE PHV ←										PHV		→ YEARS POST-PHV							
TALENT DEVELOPMENT	Investment Years			Sampling Years						Recreation Years						Specializing Years				
PSYCHO-SOCIAL DEVELOPMENT	Exploration and social interaction			Peer relationships, empowerment, self esteem						Self worth, self confidence						Sports-specific psychological skills				
	← Motivation for lifetime engagement in sports and physical activity →																			
PHYSICAL DEVELOPMENT	FMS	FMS			FMS			FMS												
	SSS	SSS			SSS			SSS												
	Mobility	Mobility						Mobility												
	Agility	Agility						Agility			Agility									
	Speed	Speed						Speed			Speed									
	Power	Power						Power			Power									
	Strength	Strength						Strength			Strength									
		Hypertrophy						Hypertrophy			Hypertrophy			Hypertrophy						
	Endurance & MC	Endurance & MC						Endurance & MC			Endurance & MC									

Figure 10 – Composite Youth Development Model for Males

Font size refers to importance; light blue boxes refer to preadolescent periods of adaptation, dark blue boxes refer to adolescent periods of adaptation. FMS = fundamental movement skills; MC = metabolic conditioning; PHV = peak height velocity; SSS = sport-specific skills.

Composite YPD Model for Females																				
CHRONOLOGICAL AGE YEARS	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21+
AGE PERIODS	Early childhood			Middle Childhood						Adolescence						Adulthood				
MATURATIONAL STATUS	YEARS PRE PHV ←										PHV		→ YEARS POST-PHV							
TALENT DEVELOPMENT	Investment Years			Sampling Years						Recreation Years						Specializing Years				
PSYCHO-SOCIAL DEVELOPMENT	Exploration and social interaction			Peer relationships, empowerment, self esteem						Self worth, self confidence						Sports-specific psychological skills				
	← Motivation for lifetime engagement in sports and physical activity →																			
PHYSICAL DEVELOPMENT	FMS	FMS			FMS			FMS												
	SSS	SSS			SSS			SSS												
	Mobility	Mobility						Mobility												
	Agility	Agility						Agility			Agility									
	Speed	Speed						Speed			Speed									
	Power	Power						Power			Power									
	Strength	Strength						Strength			Strength									
		Hypertrophy						Hypertrophy			Hypertrophy			Hypertrophy						
	Endurance & MC	Endurance & MC						Endurance & MC			Endurance & MC									

Figure 11 – Composite Youth Development Model for Females

Font size refers to importance; light pink boxes refer to preadolescent periods of adaptation, dark pink boxes refer to adolescent periods of adaptation. FMS = fundamental movement skills; MC = metabolic conditioning; PHV = peak height velocity; SSS = sport-specific skills.

Long-Term Development Model for British Judo

The proposed LTD model for British Judo, provided below, adapts the Composite Youth Development Model adding judo-specific stages of development, enabling judo coaches to align their practices with the CYD model.

BRITISH JUDO LONG TERM DEVELOPMENT MODEL FOR MALES																																							
CHRONOLOGICAL AGE (YEARS)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30+										
AGE PERIODS	EARLY CHILDHOOD			MIDDLE CHILDHOOD							ADOLESCENCE							ADULTHOOD																					
MATURATIONAL STATUS	YEARS PRE-PHV										PHV		YEARS POST-PEAK HEIGHT VELOCITY																										
TALENT DEVELOPMENT	Investment Years				Sampling Years										Recreation Years																								
																					Specialising Years																		
PSYCHO-SOCIAL DEVELOPMENT	Exploration and social interaction				Peer relationships, empowerment, self-esteem										Self-worth, self confidence																								
																					Sport-specific psychological skills																		
	← Motivation for lifetime engagement in sports and physical activity →																																						
PHYSICAL DEVELOPMENT	FMS			FMS			FMS			Fundamental Movement Skills																													
	SSS			SSS			SSS			Sport Specific Skills																													
	Mobility			Mobility						Mobility																													
	Agility			Agility						Agility						Agility																							
	Speed			Speed						Speed						Speed																							
	Power			Power						Power						Power																							
	Strength			Strength						Strength						Strength																							
	Hypertrophy			Hypertrophy						Hypertrophy						Hypertrophy																							
Endurance & MC			Endurance & MC						Endurance & MC						Endurance & Metabolic Conditioning																								
BRITISH JUDO TRADEMARKS											← Throw for Ippon →										← Win in Newaza →																		
											← Dominate Kumikate →										← Contest Management →																		
											← Fight Without Fear →																												
JUDO GRADE				WHITE	RED	YELLOW	ORANGE	GREEN	BLUE	BROWN																				BLACK									
JUDO AGE BAND				UNDER 8			MINOR				PRE-CADET	CADET		JUNIOR					SENIOR								VETERAN												
CHRONOLOGICAL AGE (YEARS)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30+										
BRITISH JUDO LONG TERM DEVELOPMENT MODEL FOR MALES																																							

Figure 12 – British Judo Long-Term Development Model for Males, adapted from the Composite Youth Development Model

Font size refers to importance; light blue boxes refer to preadolescent periods of adaptation, dark blue boxes refer to adolescent periods of adaptation. FMS = fundamental movement skills; MC = metabolic conditioning; PHV = peak height velocity; SSS = sport-specific skills.

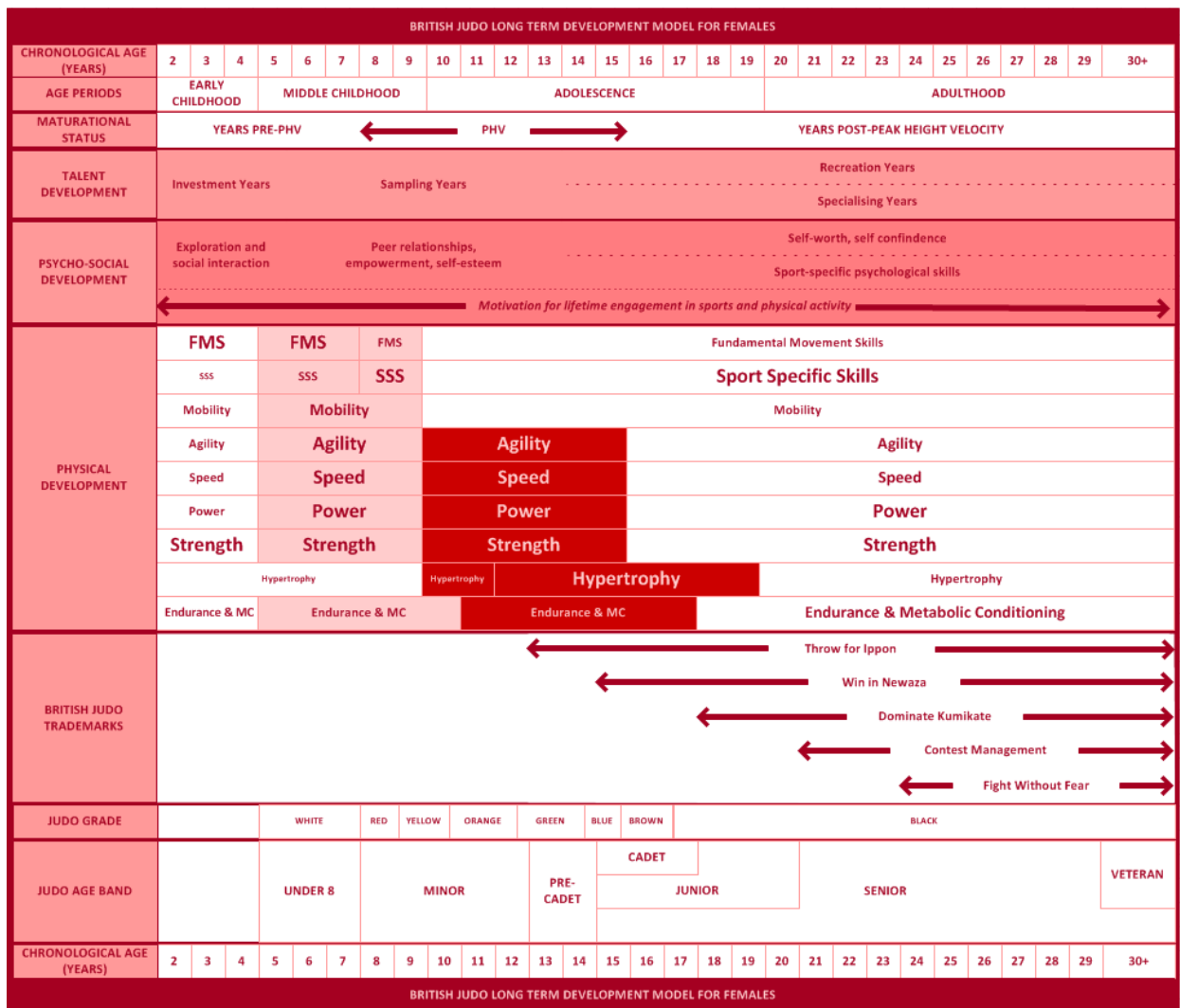


Figure 13 – British Judo Long-Term Development Model for Females, adapted from the Composite Youth Development Model

Font size refers to importance; light pink boxes refer to preadolescent periods of adaptation, dark pink boxes refer to adolescent periods of adaptation. FMS = fundamental movement skills; MC = metabolic conditioning; PHV = peak height velocity; SSS = sport-specific skills.

Long-Term Development Guidelines for British Judo

Age Period	Middle Childhood	Later Childhood	Early Adolescence	Late Adolescence	Adulthood	Adolescence to Adulthood
Maturation	• Pre-PHV	• Pre-PHV	• PHV	• PHV	• Post PHV	• Post PHV
Chronological Age	• Male: 5-8 • Female: 5-7	• Male: 9-11 • Female: 8-9	• Male: 12-14 • Female: 10-11	• Male: 15-20 • Female: 12-19	• Male: 21+ • Female: 20+	• Male: 15+ • Female: 12+
Talent Development	• Investment - Sampling Years	• Sampling Years	• Sampling - Specialising Years	• Specialising Years	• Specialising Years	• Recreational Years
Judo Age Band	• Male: 8 • Female: U8	• Male: Minor • Female: Minor	• Male: Pre-Cadet • Female: Minor → Pre-Cadet	• Male: Cadet - Junior • Female: Pre-Cadet → Junior	• Male: Senior • Female: Senior	• Male & Female: Cadet → Veteran
High Priority Physical Development	• FMS • Agility • Speed • Power • Strength	• SSS • Agility • Speed • Power • Strength	• SSS • Agility • Speed • Power • Strength	• SSS • Power • Strength • Hypertrophy	• SSS • Power • Strength	• To suit individual
Medium Priority Physical Development	• Mobility	• Mobility	-	• Agility • Speed • Endurance & MC	• Endurance & MC	
Low Priority Physical Development	• SSS • Endurance & MC	• FMS • Endurance & MC	• FMS • Mobility • Endurance & MC	• FMS • Mobility	• FMS • Mobility • Hypertrophy	

<p>Judo Specific Skill Progressions</p>	<ul style="list-style-type: none"> • Introduction to a basic range of throwing (nage-waza) techniques with emphasis on linear movement • Introduction and development of falling skills (ukemi) • Introduction to a basic range of ground grappling and holding techniques (katame-waza) using basic holds (osaekomi-waza) and escapes • Introduction to the importance of stance/posture (shizentai) • Introduction to movements with a partner (steps in sync, liner direction, diagonal movements) • Basic interactions with a partner (push, pull) • Introduction to fundamental grips (hikite-tsurite) • Introduction to unbalancing (kuzushi) skills • Introduction to 3 step entries (tsukuri) into throws from 2 feet • Learning of ~6 throws (ashi-waza, koshi-waza, te-waza) 	<ul style="list-style-type: none"> • Continued development of a wider range of nage-waza, with emphasis on circular movement • Introduction throwing (nage-komi) and to ukemi drills • Continued development of katame-waza from multiple positions • Introduction to personal techniques including development of some throws on their non-dominant side • Introduction to transition from standing (tachi-waza) to ground (ne-waza) techniques • Introduction to combination (renraku-waza) and counter (kaeshi-waza) • Reinforcement of shizentai and hikite-tsurite importance • Introduction to gripping patterns (kumi-kata) • Continued development of kuzushi skills • Continued development of tsukuri, introduction of 2 step entries into throws from 1 foot • Introduction to throwing completion (kake) skills • Learning of ~12 throws (ashi-waza, koshi-waza and te-waza) 	<ul style="list-style-type: none"> • Further development of a wide range of nage-waza, with emphasis on multi directional movement • Introduction to sacrifice techniques (sutemi-waza) • Further development of katame-waza from multiple positions • Introduction to strangles (shime-waza) and armlocks (kansetsu-waza) • Continued development of personal specialisation techniques (toku-waza) • Continued development of transition from tachi-waza to ne-waza • Continued development of renraku-waza and kaeshi-waza • Continued development of kumi-kata • Further development of kuzushi, tsukuri and kake • Learning of ~18 throws (ashi-waza, koshi-waza, te-waza and sutemi-waza) 	<ul style="list-style-type: none"> • Further development of nage-waza and katame-waza relevant to rule changes and evolution of styles, techniques and tactics • Further development of toku-waza with emphasis on completion specific skills and tactics • Continued and further development of shime-waza and kansetsu-waza • Further development of transition from tachi-waza to ne-waza • Further development of multi-directional renraku-waza and kaeshi-waza • Further development of kumi-kata • Refinement of kuzushi, tsukuri and kake • Further development of fundamental skills to move, grip and unbalance uke (tai-sabaki) 	<ul style="list-style-type: none"> • Refinement of toku-waza with emphasis on completion specific skills and tactics • Refinement of transition from tachi-waza to ne-waza • Refinement of multi-directional renraku-waza and kaeshi-waza • Refinement of kumi-kata • Constant reinforcement of kuzushi, tsukuri and kake • Constant reinforcement of tai-sabaki • Continued encouragement of originality and innovation 	<ul style="list-style-type: none"> • To suit individual
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Number and length of sessions per week	<ul style="list-style-type: none"> 1-2 sessions, 30-60mins Plus, other sports/physical activities 	<ul style="list-style-type: none"> 2-3 sessions, 60-90mins Some other sports/physical activities 	<ul style="list-style-type: none"> 3-4 sessions, 60-120mins Fewer other sports/physical activities 	<ul style="list-style-type: none"> 4-8 sessions of judo 90-120mins 4-6 sessions of S&C 	<ul style="list-style-type: none"> 6-8 sessions of judo 90-120 mins 3-5 sessions of S&C 	<ul style="list-style-type: none"> Individuals' choice
Training structure	<ul style="list-style-type: none"> Unstructured 	<ul style="list-style-type: none"> Low structure 	<ul style="list-style-type: none"> Moderate structure 	<ul style="list-style-type: none"> High structure 	<ul style="list-style-type: none"> Very high structure 	<ul style="list-style-type: none"> To suit individual
Learning methods	<ul style="list-style-type: none"> Controlled learning environment with the coaches support gradually withdrawn Learning via introduction to scenarios 	<ul style="list-style-type: none"> Gradual increase in complexity and physical demands Situational learning i.e., randori limited to certain throws, grips etc. 	<ul style="list-style-type: none"> Yakusoku-geiko (Agreed upon practice) Kakari-geiko (Continuous attack practice) Randori (Open competitive practice) 	<ul style="list-style-type: none"> Yakusoku-geiko Kakari-geiko Randori 	<ul style="list-style-type: none"> Yakusoku-geiko Kakari-geiko Randori 	<ul style="list-style-type: none"> To suit individual
Type/amount of competition	U8 Judo Festivals 4-6 Events per year	Red Belt Rumbles Club Mini-Mons Area Closed 6-8 events per year	Club Opens Area Opens National International 8-10 events per year	Area National International 10-12 events per year	National International Periodised competition programme	Veterans
Number of gradings per year	2-3 Sho gradings	2-3 Mon gradings	2-3 Mon gradings	1-2 Kyu gradings	1 Dan grading every 3-5yrs	Own choice
Training venues	School Club	School Club	School Club Regional National	Club Regional National	Club Regional National	University Club

Physical Component Trainability

Fundamental Movement Skills	FMS are viewed as the building blocks for sport-specific movements and should be the focus of physical development in early and middle childhood (Deli, Bakle & Zachopoulou, 2006) their development is essential to ensure that correct movement patterns are mastered to enable effective performance of more complex skills (Oliver, Lloyd & Meyers, 2011). Additionally, FMS should always be present within any strength programme for athletes of all ages (Lloyd, Oliver, Meyers, Moody & Stone, 2012).
Sport-Specific Skills	SSS should become the focus from adolescence onwards; though the development stage of the athlete also needs to be considered (Lloyd & Oliver, 2012).
Strength	Strength development is multifaceted, strength gains can be made not only from muscle fibre hypertrophy through muscle cross-sectional area increases, but also as a result of a combination of mechanical and muscular neural factors (Aagaard, 2003). Strength development should be a priority at all stages of development for both males and females, as it also improves power (Stone et al., 2003), speed (Weyand, Sternlight, Bellizzi & Wright, 2000) and endurance (Hoff, Helgerud & Wislooff, 1999) plus is important for FMS development (Behringer, Heede, Matthews & Mester, 2011) and injury reduction (Clark, Tobias, Murray, & Boreham, 2011).
Hypertrophy	Hypertrophy training may begin at PHV (around 14yrs for males and 12yrs for females) when levels of growth hormone and testosterone increase most rapidly (Malina, Bouchard & Bar-Or, 2004).
Power	Power develops most rapidly during adolescence and continues through adulthood, due to maturation influencing gains in muscle power (Beunen & Malina, 1988); however, as muscular strength can be developed through training in childhood so can muscular power (Rhea, Peterson, Lunt & Ayllón, 2008) therefore power should also be trained throughout middle childhood and beyond (Lloyd & Oliver, 2012).
Speed	Speed is trainable throughout childhood and adolescence (Rumpf, Cronin, Pinder, Oliver & Hughes, 2012). Children tend to benefit more from plyometrics, technical competency and sprint training, though adolescences respond more to strength training, plyometrics and sprint training to maximise speed gains (Lloyd & Oliver, 2012).
Agility	Agility consists of the subcomponents of 'change of direction speed' (technique, straight sprinting speed, lower limb strength and anthropometry) and 'cognitive function' (perceptual and decision-making processes). As strength and speed can be developed in childhood basic agility should be trained in early childhood, progressing to more sport-specific agility in adolescence (Lloyd & Oliver, 2012). During adolescence children experience rapid gains in limb length leading to decrements in motor control, during this phase of "adolescence awkwardness" movements patterns may need to be re-perfected (Drabik, 1996).
Mobility	Mobility never emphasised as a focus of physical training during any of the age periods; however, it must be regarded as an essential part of any athletic programme. Research suggests that middle childhood (5-11yrs) is a critical period of development for flexibility (Sands, Caine & Borms, 2003). Once the required levels are achieved, they should be maintained throughout adolescence and adulthood (Lloyd & Oliver, 2012).
Endurance & Metabolic Conditioning	Endurance & MC is also never emphasised as an area of focus, as sport-specific endurance is typically developed during the skills sessions of any given sport. More focus in this area should be given at later adolescence as endurance is influenced by growth-related changes in cardiovascular systems, metabolic capacities and neuromuscular functions throughout childhood (Rowland, 1985), additionally as it is a physiological component that remains trainable in adulthood (Lloyd & Oliver, 2012).

Summarised from the Youth Physical Development Model (YPD; Lloyd & Oliver, 2012)

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